Vol. XII. JANUARY, 1896. No. 1.

JOURNAL

OF THE

New-York Microscopical Society

EDITED BY

REV. J. L. ZABRISKIE,

28 REGENT PLACE, FLATBUSH STATION, BROOKLYN, N. Y.

CONTENTS.

	PAGE.
I. A New Mineral Box, and Rotating Stage-Holder. By JAMES WALKER. [Plate 52]	1
II. Microscopical Identification of Starches. By EDWARD G. LOVE	5
III. Sand; the Method of its Study. By A. A. JULIEN	13
IV. Proceedings	17

New-York:

PUBLISHED FOR THE SOCIETY,

QUARTERLY.

PRESS OF DOUGLAS TAYLOR & CO.
No. 8 WARREN STREET.
1895.

[Entered at the Post-Office at New-York as second-class matter.]

New-York Microscopical Society.

OFFICERS FOR THE YEAR 1896.

President,	Edward G. Love.
Vice-President,	Frank D. Skeel.
Treasurer,	James Walker.
Recording Secretary,	George E. Ashby.
Corresponding Secretary,	J. L. Zabriskie.

Committee on Admissions.

Henry C. Bennett, George H. Blake, Thomas S. Nedham, Frederick Kato, W. J. Lloyd.

Committee on Publications.

J. L. Zabriskie, Frank D. Skeel, George W. Kosmak, Edward G. Love, H. A. Parmentier.

Regular Meetings on the first and third Fridays of each month, from October to June, inclusive, at 8 P. M., at No. 64 Madison Avenue, New-York City.

JOURNAL

—OF THE—

NEW-YORK MICROSCOPICAL SOCIETY

CONTAINING ITS TRANSACTIONS AND PROCEEDINGS.

PUBLISHED QUARTERLY.

All communications for the JOURNAL, all subscriptions, and all exchanges, should be addressed to the editor, Rev. J. L. Zabriskie, 28 Regent Place, Flatbush Station, Brooklyn, N. Y.

Terms of Subscription:—In the United States, Canada and Mexico, One Dollar per annum, beginning with the January number. In other countries, One Dollar and Twenty-five Cents per annum.

F. W. DEVOE & CO.,

(ESTABLISHED IN 1852.)

Fulton Street, corner of William Street,

NEW YORK.

ARTISTS' MATERIALS,

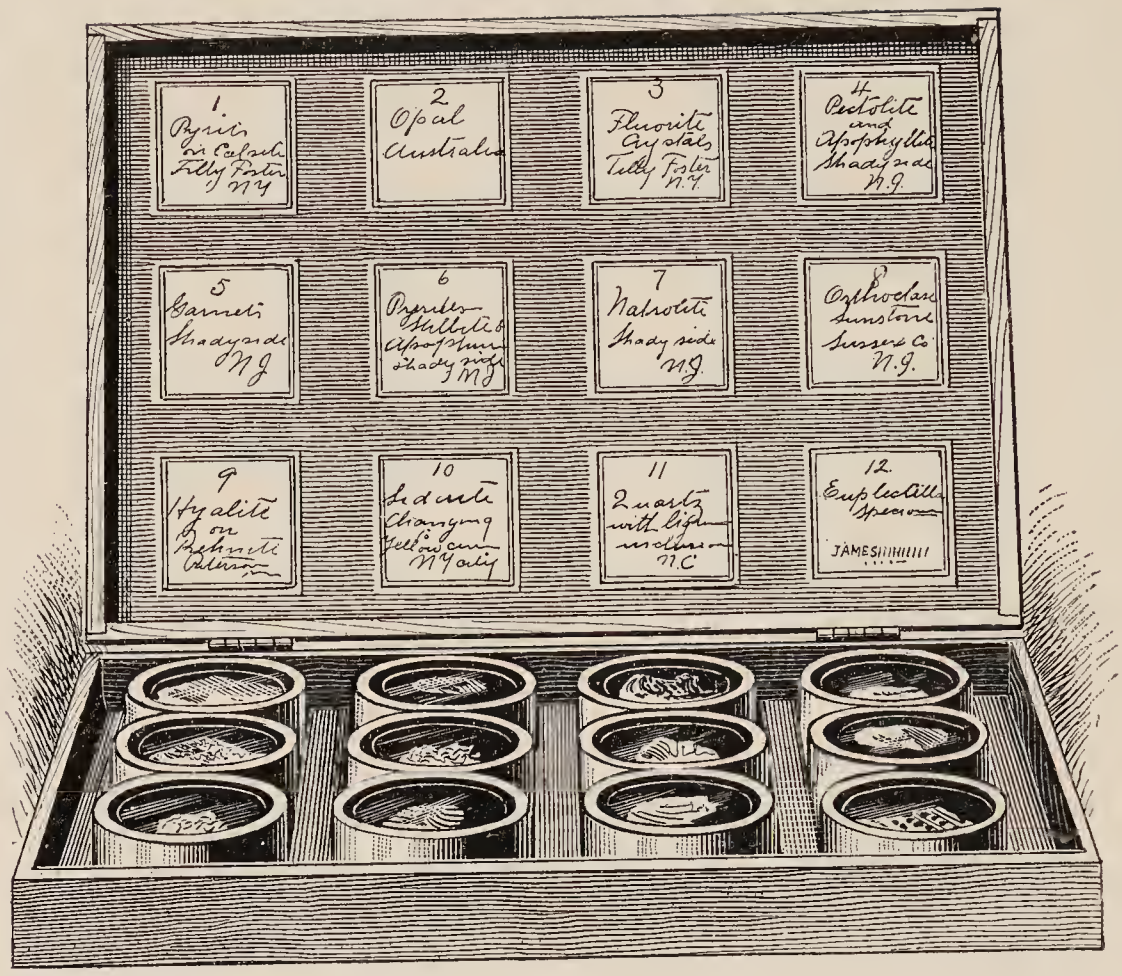
OF ALL KINDS,

FINE BRUSHES, MATHEMATICAL INSTRUMENTS,

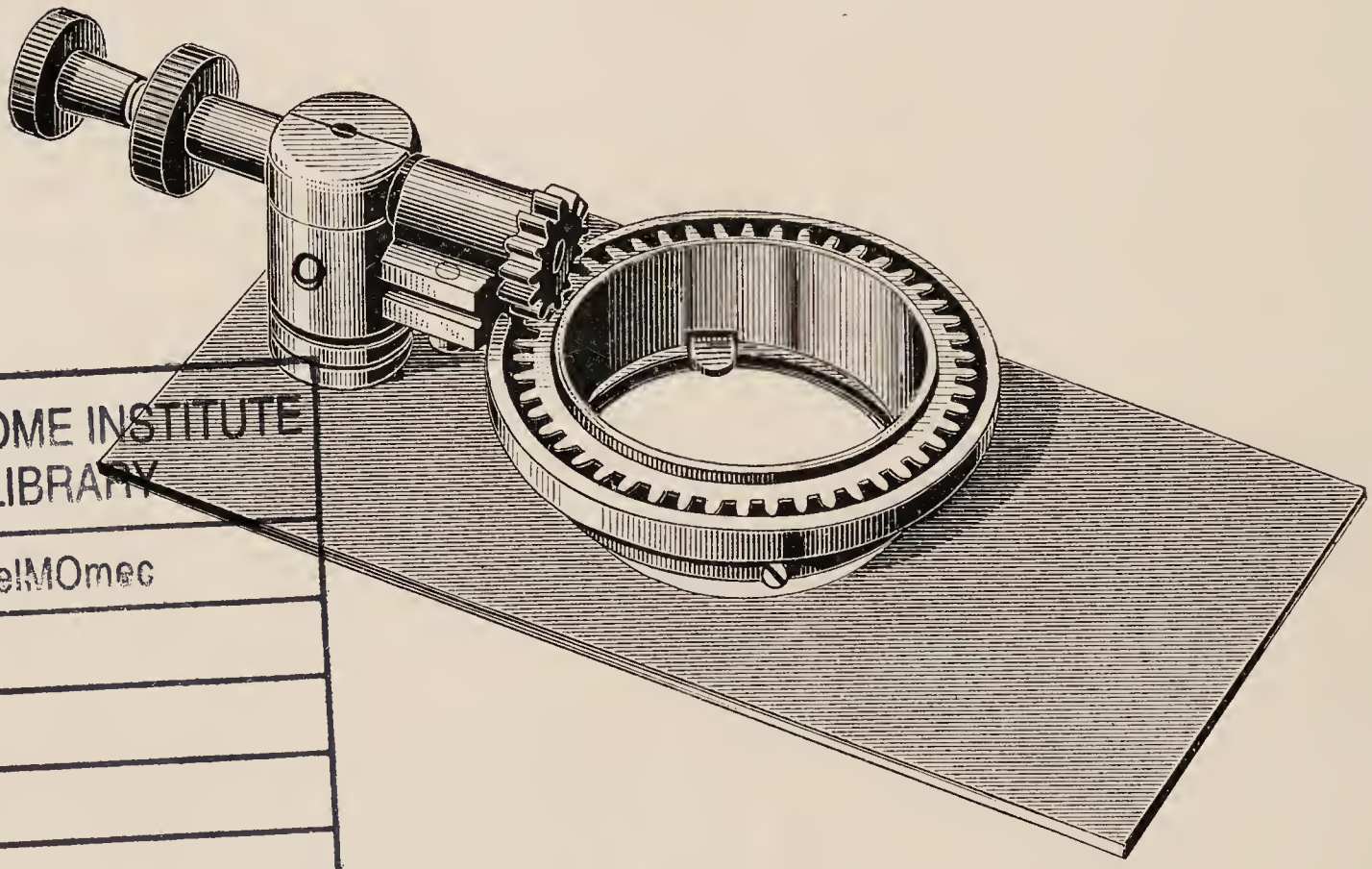
COLORS, VARNISHES.

Digitized by the Internet Archive
in 2019 with funding from
Wellcome Library

https://archive.org/details/s962id11784190



1.



2.

WELLCOME INSTITUTE LIBRARY
WelMOmec

MICROSCOPICAL EXAMINATION OF MINERALS.

1. Tray with specimens.
2. Rotating stage holder.

JOURNAL

OF THE

NEW-YORK MICROSCOPICAL SOCIETY

VOL. XII. JANUARY, 1896. No. 1.

A NEW MINERAL BOX, AND ROTATING STAGE-HOLDER, FOR THE EXAMINATION OF MINERALS UNDER THE MICROSCOPE.

BY JAMES WALKER.

(*Read June 7th, 1895.*)

In my frequent visits to mineral localities in the vicinity of New-York, I have picked up from time to time many very beautiful little groups of crystals that were too small to put in my cabinet with larger specimens, and too large to mount in the metal, rubber, or glass cells, that were sold by the dealers in microscopical supplies.

For some time I mounted these little gems in round pill boxes. That answered very well for a time, until I found that many of them had lost much of their beauty and brilliancy, by being covered with particles of dust, while uncovered on the stage of the microscope. I then came to the conclusion that there was only one proper way to mount such objects, for examination under the lens, and that was in round brass boxes with a glass cemented in the cover of the box, so that the cover could be removed if desirable, on account of the fogging of the glass, or for the more critical examination of the object. The latter necessity will rarely occur, as the low powers only will be used, and the definition suffer very little, if any, from the cover glass.

My first intention was to make a drawing of exactly what I wanted, take it to some manufacturer of brass goods, have a die made and have four or five hundred struck up from it of the required size. I was spared the necessity of that, however, by finding a box in the market of exactly the right diameter, with a snug fitting cover, but a little too high and with no opening in the cover for the glass.

I procured a few hundred of these and after a little practice I succeeded in turning out a box to my liking. The box as now finished is 1⅛ in. outside diameter, measured across the cover, and is ½ in. in height. It has a close fitting cover, with a ¾ in. opening and a recess spun around the edge, to take a ⅞ No. 2 cover glass. The diagram (Fig. 1) will show it better than I can describe it. The glass is fastened to the cover with a cement made of equal parts of Venice turpentine and shellac, melted over a sand bath, rolled into sticks, and afterwards broken up in alcohol, forming a solution about as thick as ordinary varnish. I have used this because it was convenient, as I use it in the stick for cementing chips of rock to pieces of thick glass to grind down sections, and it has no equal for that purpose. It is also an excellent cement in that form for making troughs for pond-life. I have not used it long enough to give it an unqualified recommendation, for fastening glass to brass, but so far it has answered very well.

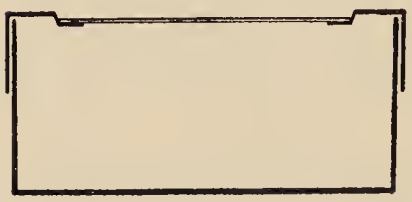


FIG. 1. SECTION OF BRASS BOX.

The specimens are mounted on corks, which I procured of the exact size of the box. The same cement was used for fastening the minerals on the corks, and the corks in the boxes A thin coat of black varnish, on the cork not covered by the specimen and around the inside of the box, adds to the appearance of the mounts. A ring of the same material over the cement of the cover glass looks well.

Although this method of mounting in brass boxes, so far as the boxes were concerned, was perfectly satisfactory, there was one thing wanting, and that was a box holder capable of a universal motion that would present all parts of the object to view. The accompanying illustration (Plate 52, Fig. 2.),

together with the following description, will show the box holder that I made, which, in some degree at least, accomplishes what was wanted. It consists of a brass plate 3½ in. long by 1¾ in. wide with a 1 in. aperture in the center. On one end of this plate is planted a short pillar, which supports and furnishes a bearing for a hollow stem. On one end of this stem is turned a milled head, and the other end carries a ring of $1\frac{9}{16}$ in. outside diameter. The pillar is made in two parts, which are held together by a screw and steady pin, so that the friction on the bearing can be regulated as desired. The end of the hollow stem, opposite the milled head, and its junction with the ring, can be better understood by reference to the diagram of a section of that end, just back of the pinion (Fig. 3). The upper part represents the hollow stem and the lower part the projecting lug on the side of the ring, which is secured to the stem by two screws.

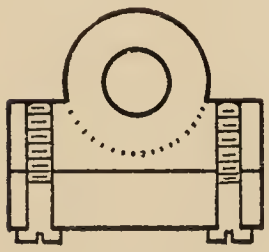


FIG. 3. SECTION OF HOLLOW STEM AND LUG.

Into this ring is fitted the box carrier, which has a toothed ring on the upper end, while another ring, with three inward projecting pieces, encircles the lower end, and prevents the carrier from falling out of its place in the ring. The projections, one of which is shown in the engraving, serve as a seat for the box. Passing through the hollow stem is a rod with a pinion on one end, which gears into the toothed ring of the carrier. On the other end is a small milled head for turning it.

It will be understood from the foregoing description that, by means of the large milled head, the box with object, when placed in the holder, can be inclined at any angle to the stage, and, by use of the small milled head, it can be rotated in that plane, and the object can be examined in any position desired.

There is a class of minerals, such as Opal, Aventurine, Labradorite, Moss agate, and many others, with inclusions, which are best seen by reflected light. They are usually cut or ground into thick slices, polished on one side, and cemented to the ordinary glass slip. These specimens can be seen to much greater advantage if mounted in the brass boxes. They

should be ground down smooth on one side—polishing is not necessary—and cemented with balsam to the under side of the cover glass. The balsam gives a better surface for examination with the microscope than the polish of the lapidary, no matter how well it is done. The first two minerals mentioned are especially fine as they are rotated in the holder, and the light strikes them at different angles.

These boxes are also excellent for mounting Foraminifera if arranged in a circle on a blackened cork, or piece of black paper. They can be passed in review in the nicest manner. Other applications will suggest themselves to the ingenious microscopist.

I have arranged the brass mounts in shallow wooden boxes, 4 by 6 inches outside measurement. They are placed in four rows of three each, with a quarter inch strip between the rows and at the sides, which makes it easy to remove the boxes for examination. Each mount is numbered on the rim of the box cover and also on the bottom of the box, corresponding numbers are written on labels, with the name and locality of each specimen, and these are pasted on the inside of the cover of the wooden box (Plate 52, Fig. 1).

To the Rev. Dr. Rakestraw, of Philadelphia, is due the credit of first calling the attention of American microscopists and mineralogists to the beauty of a large variety of minerals when viewed under the microscope as opaque mounts. His method is to mount the specimens in small rectangular 1⅛ by ⅞ in. paper boxes. The name and locality are marked on the cover, which is removed when the boxes are placed on the stage of the microscope. They have become popular, and similar mounts are now found in many of the cabinets of our microscopists.

NOTES ON THE MICROSCOPICAL IDENTIFICATION OF STARCHES IN FOOD ADULTERATION.

BY E. G. LOVE.

(*Read January 17th, 1896.*)

Chlorophyll is the connecting link between inorganic and organic bodies in nature. Under the influence of light it effects the assimilation of carbon dioxide and water, and the production of certain organic bodies called carbo-hydrates, which in a soluble form pass to all parts of the plant to serve in the building up of protoplasm.

Starch makes its first appearance in the vegetable economy as minute grains in the chlorophyll bodies of the plant; but these rapidly disappear, especially when deprived of light, and assume a soluble form as plant food.

The starch which forms the more permanent accumulations in tubers and seeds is produced from the protoplasm of the cell, a process in which light is not essential. The same is true when these reserves of plant food are to be utilized in the formation of new tissue, and the starch, under the influence of an organized ferment, again assumes a soluble form.

As the formation of starch from the protoplasm progresses, the latter gradually disappears until scarcely any remains, and the cell is filled with starch granules. These granules as obtained from various sources vary greatly in size and shape, and while this is true in a limited degree of the granules from any one plant, there are still sufficiently characteristic differences between the starches from different plants to serve in most cases as a means of identification.

Under favorable conditions many starch granules have the appearance of distinct stratification, marked by faint lines arranged concentrically or eccentrically around a spot or slit called the nucleus or hilum. In the starch of potato these lines are quite distinct, but in other starches, such as wheat, in which they are invisible under ordinary conditions, they may be developed by the application of certain reagents, as chromic acid.

The cause of this stratified appearance is thought to be the presence of more water in some layers than in others, making them of different densities. The quantity of water increases as we approach the nucleus, and as the older granules lose this water by evaporation the consequent contraction produces cavities of greater or less dimensions which in many granules are round, while in others they assume the form of a slit or stellate fracture.

The position of the nucleus in the granule, and the fact that the arms of the cross seen with polarized light meet at this point, are important aids in the identification of starches.

Chemically the starch granule is composed of two distinct but clearly related bodies, granulose and starch cellulose. The former makes up the larger part of the granule, and is readily soluble in saliva, pepsin, organic acids, etc., and is colored blue by a dilute solution of iodine. On the removal of this granulose by some solvent there is left a skeleton of cellulose, which because it is related to but not identical with ordinary cellulose is called starch cellulose. Iodine colors it yellow instead of blue. It is owing to this protective coating that starch is not acted upon by cold water, but on the application of heat the granules burst and there is formed a gelatinous, slightly opalescent mass.

In the identification of starches the most important points to be observed are the size and shape of the granules, and their appearance with polarized light, the latter showing the position of the nucleus.

In very young granules the form is that of a sphere with the nucleus at the center, but as they increase in size the growth may be equal on all sides of the granule in any one plane and the granule becomes lenticular, as in wheat; or the growth may take place almost entirely on one side of the nucleus, producing granules of the form of a flattened ovoid. Sometimes the granules resemble a kettle-drum as though a sphere or ellipsoid had been cut in two, or they may be merely truncated ovoids.

In describing the shape of starch granules it is customary

to give the form of a longitudinal section of the granule, without reference to their solidity.

The distinctness of the lines on the granules are useful indications in some cases, but as a general thing they are of less importance.

We have found it most convenient to begin the examination of suspected material with polarized light, crossing the Nicols to give a dark field. With a slide well filled with material, and a familiarity with the more common starches, a hasty examination is often sufficient to establish the identity of the starch present. At all events the procedure enables us to say that certain starches are not present, and so by a process of elimination greatly facilitates the more systematic examination.

It is of great advantage always to make the examination of starches under the same conditions of light and magnifying power; and when comparisons are to be made it is important that the mounting media should be the same. The magnifying power should be sufficient to bring out the characteristics of the smaller granules and not so great as to unnecessarily limit the field when the larger granules are under examination. A power of about 250 diameters, or a $\frac{1}{4}$-inch objective, answers in most cases, with a $\frac{1}{6}$-inch for special work.

Many observers always employ oblique light, while others use oblique or central as the case may require.

There is little call for the staining of starch granules. The well-known action of iodine upon starch, coloring the granules a deep blue, is often of advantage in detecting starch in the presence of much foreign matter. Many stains, however, familiar to the microscopist serve this purpose in case of need, notably rosaniline which gives a good red.

The mounting medium is a matter of some importance, and a large number of solutions have been recommended for this purpose. The best results with polarized light are obtained when balsam is used; and the photomicrographs which I submit for your examination were made from such mounts. At the same time balsam is not well suited for starches to be examined without a polarizer, as its index of refraction is too high. I have used an alcoholic solution of copal with very

satisfactory results, and mounts prepared with this medium are placed on several of the stands for your examination. It answers very well when ordinary light is employed, and also brings out the characteristics of the granules with sufficient clearness when the polarizer is in use.

For aqueous media, camphor water, or a mixture of glycerine and water, sometimes with the addition of alcohol, are more generally used.

Mounted preparations of the starches are very useful for ready reference, and when carefully made will last indefinitely; but in important work it is essential that the microscopist be provided with fresh starches for purposes of comparison. These should be prepared by the microscopist from original sources, and should be preserved in a dry state, most conveniently in small, wide-mouth vials, properly labeled. When obtained at second hand the fact should be so stated on the label, and if there is the slightest doubt as to the identity of the specimen it should never have a place in such a collection.

In the preparation of these starches the grain, tuber, etc., is gently ground or rasped to tear open the cells, and the resulting mass washed with water upon a fine sieve. Sometimes this treatment furnishes the starch in a fairly pure condition, as in the case of potato, but more commonly it is mixed with more or less nitrogenous matter. In the commercial preparation of starch these foreign substances are largely removed by a fermentation process, or by treatment with very dilute alkali. The same methods may be employed in preparing starch for microscopical study, but should be used with caution, as the form, size and character of the starch granules should remain unchanged. A solution of caustic soda containing three grams to the litre removes the nitrogenous substances without action upon the starch granule, after which the starch is well washed with pure water. The washing is usually effected by allowing the starch to settle and removing the supernatant liquid. It is very important that a sufficient time be allowed for the starch to settle completely, otherwise the smallest granules which in some cases require many hours

to settle will be lost. The importance of this is clearly shown in the two photomicrographs of potato starch which I now show you. One represents the granules which settled first from the wash water, and which are all of large size, while the other shows the nature of the last settlings in which the granules are all very small, and which would very naturally puzzle a microscopist to identify.

It is often an advantage to remove other foreign material from these starches by a preliminary treatment with ether for the removal of fat, and in certain cases with alcohol for coloring matter, etc.

Much information and help in the microscopical examination of starches can be gained by a study of the papers published on this subject; but this cannot take the place of a study of the starches themselves, which is very essential to one desirous of becoming familiar with the subject.

For the benefit of those present who may not be familiar with the starches I have put upon the board a list of those which are ordinarily met with as food adulterants, together with the shape and size of the different granules.

* * * * * * *

I have prepared a series of photomicrographs for your examination, including the starches of wheat, barley, rye, corn, pea, bean, potato, maranta, cassava or tapioca, canna or tous-les-mois, banana, yam, maranta adulterated with corn, and a mixture of potato and corn sold for maranta; also a series of pen-drawings of most of the foregoing, together with those of sago, oat, buckwheat, and rice. The photomicrographs all represent a magnification of 500 diameters.

The food substances submitted to the analyst for microscopical examination with a view of determining the presence of foreign starches are usually in the form of a powder or of very small fragments; and when no quantitative examination is desired it is often of advantage first to treat the material with solvents, such as alcohol and ether, which, while having no action upon the size or form of the starch granules, remove the fat, and usually the coloring matter and certain other substances, thus facilitating the subsequent microscopical work.

This preliminary treatment is rather more desirable when the starch is likely to be accompanied by a considerable quantity of other matter.

When one has acquired a knowledge of the peculiarities of the different starches there is no special difficulty in identifying them when mixed with other material, and I will therefore merely call your attention to a few articles of food in which starches are frequently found as adulterants.

Mustard is an article which as sold for table use always contains foreign starches. In some States the sale of a mustard mixture is allowed provided certain conditions are complied with. Mustard itself does not contain starch, so that the examination of this substance presents no difficulty. The starches commonly found in the mixture are wheat, corn, rice, and occasionally potato. Turmeric is added to give a yellow color, and as this substance contains starch one must be familiar with these granules before proceeding with an examination.

The ground spices have always been subject to gross adulteration, not only with foreign starches but with various other materials, which by grinding to a powder could be made to resemble the particular spice it was intended to adulterate. It is the presence of the latter class of adulterants which the microscopist finds it most difficult to detect and identify. So far as foreign starches are concerned the problem is easy, provided one is familiar with those naturally occurring in many of the spices, such as pepper, ginger, cassia, cinnamon, nutmeg, etc.

It is not uncommon to find one starch or flour adulterated with some other one of less commercial value. Several years ago this was very noticeable in the case of Maranta arrowroot, but at present the adulteration with cheaper starches is not so frequent.

The substitution of one starch for another is carried to the extreme in the case of tapioca and sago. The former is the starch obtained from the tubers of *Manihot utilissima*, and is often called cassava. It appears in commerce in several shapes, the most common being as pearl tapioca. At one

time there was also in the market a pearl sago obtained from the starch of the sago palm; but at present this is entirely replaced by tapioca, which, however, is sold as sago. In the trade a distinction is often made between pearl tapioca and "pearl sago," the former term being applied to the product of a much coarser granulation. In the preparation of the tapioca of commerce heat is used, and consequently many of the starch granules appear in a greatly altered form.

Coffee in its ground condition is frequently adulterated, the additions more commonly found being chicory, rye, peas, wheat, and oats. As in the case of mustard the law of this State allows the sale of a coffee mixture which may contain chicory, peas, or cereals, but which must contain at least fifty per cent. of pure coffee; and the true nature of the mixture must be stated upon the label of each package.

In coarsely ground coffee the foreign ingredients may oíten be picked out by the aid of an ordinary magnifying glass, and it is seldom that the microscopist is called upon to make the more elaborate examination. Chicory, which is the most common adulterant of coffee, is free from starch, and its microscopical detection depends upon a knowledge of its different tissues. The other adulterants mentioned are composed largely of starch; and their detection is attended with no special difficulty, except in distinguishing between wheat, barley, and rye, the peculiarities of which have been already referred to.

Of late years a large number of cocoa preparations have appeared in the market, many of which contain foreign starches.

The cocoa bean is the seed of *Theobroma cocoa*, a plant which bears fruit the year round. From thirty to forty beans, surrounded with pulp, are contained in a single pod. On gathering the fruit the beans are removed and dried, and after roasting to develop aroma, are cracked to facilitate the removal of the husks or shells, and the beans are then known as cocoa "nibs," from which the various cocoa preparations are made.

About fifty per cent. of all cocoas and chocolates found in

this market contain some foreign starch. The most common of these is wheat, then arrowroot, corn, and rice. The cocoa bean itself contains a small quantity of starch; but there is no difficulty in distinguishing it from the other starches mentioned, unless it be from the smaller wheat granules.

The list of food articles to which starch in one form or another has been fraudulently added might be considerably extended; but enough has already been said to indicate the extent to which this is carried, as well as the nature of the microscopical work necessary for the detection of these adulterations, and the degree of success which one with care and patience may expect to attain.

SAND; THE METHOD OF ITS STUDY.

BY ALEXIS A. JULIEN.

(*Read November 15th, 1895.*)

[Author's Abstract.]

The complete investigation of a sample of sand must have two objects in view: first, the analytical examination and identification of the sand-grains; secondly, the determination of the physical properties of the sand, in mass.

I.—Identification of Sand-grains.

For this purpose four general methods of examination become necessary.

A.—Mechanical Examination.

1. *Size* of grains.

Direct measurement under the microscope, preferably by means of a Jackson eye-piece-micrometer, with glass plate divided in small squares, in place of the usual linear scale. Tabular form of average sand-grain, and its three dimensions, of which one, breadth, is the most important.

2. *Shape* of grains. Two methods.
   a—Drawing, with assistance of camera-lucida, camera-obscura, or projection-prism.
   b—Photography, by reflected light, with precautions to avoid glaring spots.

3. *Hardness* of grains. Each selected grain mounted in end of soft metal bar, *e. g.*, printing-type, as handle, by means of which to scratch the faces of mineral-fragments of the "hardness series."

4. *Density* of grains. Two methods.
   a—Immersion in micro-cells, in dense liquids of known specific gravity.
   b—Observations during mechanical separation in dense liquids (see paragraph 18, *b*).

B.—Chemical Examination.

5. *Qualitative reactions.* Examples: Metallic iron reaction by means of copper sulphate, in artificial sands, cosmic

dust, volcanic ash, etc.; zirconia reaction, by fusion with sodium dicarbonate, etc.

6. *Blowpipe tests.*

a—Fusibility, for distinction of feldspars from quartz, kyanite, etc.

b—Fusion-reactions, *e. g.*, of titanic acid (in rutile, brookite, etc.), in beads of potassium disulphate, phosphor-salt, etc.

c.—Flame-coloration (Szabó's), for distinction of feldspars.

7. *Absorption-spectra*, by means of micro-spectroscope, for recognition of monazite, certain garnets, etc.

8. *Quantitative analysis*, for determination of special constituents (*e. g.*, iron-oxide in a glass-sand), of constitution of a homogeneous sand, etc.

C.—Optical Examination. Three Branches.

9. *Exterior contour* and detail. Special methods of mounting for study by reflected light.

a—Sculptured contour, with its revelations of genetic history of the sand-grain.

b—Exterior markings of three kinds: shagreen or pitting by wind-action, striæ by glaciation, and polish by water and wind-attrition.

10. *Interior structure* and detail. Special methods of mounting and preparation of thin sections of sand, for examination by transmitted light, ordinary and polarized.

a—Recognition of axes of elasticity, with special adjustment of grains.

b—Twin lamellation (*e. g.*, in feldspars).

c—Pleochroism (*e. g.*, in rutile, tourmaline, etc.).

d—Enclosures (*e. g.*, amphibole, rutile, mica, hematite, fluid cavities, etc.); their evidences of origin of enclosing minerals and rocks.

11. *Refractive index.* Three methods of determination in sand-grains.

a—Immersion in series of test-solutions of determined indices; recognition by disappearance or by shagreened

effect, under the microscope; methods and apparatus for determination of indices in liquids, *e. g.*, by Smith's homo-tester, etc.

b—Duc de Chaulne's method.

c—Series of comparison plates of minerals of known indices.

D.—Concentration Methods.

Object, to provide favorable material for examination by methods already considered.

12. *Concentration by picking.*

Separation by hand of special mineral grains out of sand by means of needle touched with wax, thin waxed thread, needle electrified by rubbing, or pointed match with moistened end.

13. *Concentration by rolling.*

Separation of round grains, concretions and foraminifera, by rolling down inclined planes; also of flat grains or plates (*e. g.*, of mica, feldspar, kyanite, etc.), by sliding over inclined surface of rough paper, or down the moistened sides of a funnel.

14. *Concentration by washing.*

Separation of lighter grains from a heavier residue (*e. g.*, iron-ores, gold, tin-oxide, etc.), by whirling motion in water; also by levigation, through deposit of heavier particles from suspension in water (*e. g.*, diatoms from sand, and sand-grains from silts and clays).

15. *Concentration by sieving.*

Separation of the heavier minerals in the finer silts, with particles less than 0.2 milligram in diameter.

16. *Concentration by magnetic attraction.*

Separation of magnetite, metallic iron, meteoritic particles and pyrrhotite by means of bar-magnet, as well as of amphibole, pyroxene, olivine, epidote, garnet, etc., by means of electromagnet.

17. *Concentration by solution.*

Separation of insoluble particles by chemical solution of sands, *e. g.*, pumice, lava, etc., from calcareous sands, by

digestion in dilute acids; or of zircon, rutile, cassiterite, etc., by treatment of siliceous sands in hydrofluoric acid.

II.—Physical Properties of Sand.

Their relation to the economic application of this material.

18. *Mineral-constitution.*

Determination of the intermixture-proportion of different minerals; two methods.

a—Direct counting, under low magnifying power, of grains spread over a micrometer coarsely divided in squares.

b—Mechanical separation, in dense liquids of known specific gravity, by deposit during successive dilutions.

Use of Sonstadt, Klein, Rohrbach and Braun solutions, and of fusion-mixtures.

19. *Assortment by size.*

Passage through a series of sieves, preferably of perforated metal plates rather than wire-netting. Different effects of sliding and of jigging motions, and relation to a single dimension, breadth.

20. *Specific gravity.* Two methods.

a—Material of the sand: determined by pycnometer, in usual way.

b—Entire sand, with interstices: determined during enclosure in sealed glass tube of known weight and specific gravity. Calculation of weight of definite volumes of sand.

21. *Absorption and voids.* Two methods.

a—Calculation from data just obtained (paragraph 20).

b—Piefke's direct determination on large sample, in funnel.

22. *Permeability.*

Direct determination in half-filled glass cylinder.

23. *Flotation.*

Immersion on inclined glass plate.

24. *Sonority.*

Agitation in test-tube and bag.

PROCEEDINGS.

Meeting of October 4th, 1895.

The President, Dr. Edw. G. Love, in the chair.

Twenty-one persons present.

OBJECTS EXHIBITED.

1. Transverse section of upper jaw of Mole.
2. Longitudinal section of lower jaw of the same.
3. Longitudinal section of upper jaw of Kitten.
4. Longitudinal section of tooth of Shark.

Exhibits Nos. 1–4 by Charles S. Shultz.

5. Pond-life, *Plumatella*, &c.: by Horace W. Calef.
6. Spores from the waters of the Adirondacks: by Edw. G. Love.
7. Photomicrographs and diagrams of the mouth-parts and ovipositor of *Cicada septendecim:* by J. D. Hyatt.

The President explained that the spores exhibited by him were from Sherman's Pond, south of Schroon Lake, at the entrance of the Adirondack region. In late summer the waters of the smaller lakes and ponds of the region are inclined to become very foul from the presence of inconceivable numbers of little spheres. The residents call this the "blowing" of the waters, supposing it to be occasioned by the eggs of small animals. But the spheres are really vegetable spores. The small dark spheres are the spores of *Nitella*, and the larger ones the spores of *Œdogonium*.

Mr. Hyatt gave an interesting description of the natural position and the method of sectioning the parts of *Cicada* exhibited by him.

Meeting of October 18th, 1895.

The President, Dr. Edw. G. Love, in the chair.

Twenty-three persons present.

Messrs. Charles P. Abbey and George W. Muller were elected resident members of the Society.

Mr. Henry Orford read a paper, entitled "A Modern Microscope Objective." This paper was illustrated by blackboard diagrams, and is published in the JOURNAL, Vol. XI., p. 106.

OBJECTS EXHIBITED.

1. Young specimen of Horse-shoe Crab, *Limulus*.
2. Cast shell of the same.
3. Compound eye of the same, showing multiple images.
4. Eyes of the Scallop, *Pecten*, mounted in glycerine.

Exhibits Nos. 1–4 by F. W. LEGGETT.

5. Photomicrographs of eye of *Pecten*, from sections prepared by Mr. L. Riederer: by EDW. G. LOVE.

6. *Bacillus tuberculosus*, under a $\frac{1}{12}$ Bausch & Lomb objective with excellent working distance: by FRANK D. SKEEL.

Mr. Leggett explained that his specimens of *Limulus* were collected at Cape Cod during the summer just passed. His exhibit No. 1 was bleached in carbolic acid and mounted in glycerine in a deep cell of his own manufacture—an excavated block of wood cemented between two squares of thin glass. The compound eye, exhibit No. 3, was cleared from pigment, bleached in carbolic acid, flattened under pressure, and mounted in glycerine jelly. These exhibits opened the way for many questions and an interesting discussion on the habits of *Limulus* and *Pecten*.

MEETING OF NOVEMBER 1ST, 1895.

The Vice-President, Dr. F. D. Skeel, in the chair.

Nineteen persons were present.

OBJECTS EXHIBITED.

1. Diatoms from Banister's Creek, Rockaway, N. Y., abundant forms: by JAMES M. B. HARD.

2. Section of obsidian, with incipient cyrstallization, from Glass Mountain, Yellow Stone Park: by J. D. HYATT.

3. A fibrous combustible substance, evidently coniferous

wood fibre, which rises in the geysers and hot springs of Yellow Stone Park: by J. D. HYATT.

4. Seeds of the White Birch, with wings and two filaments like antennæ of insects: by J. D. HYATT.

5. Aquatic life; three of the "new forms" found by Mr. Helm in 1891 (See JOURNAL, viii. 43), from the Morris and Essex Canal, N. J.: by JAMES WALKER.

6. Eggs, embryo, and young (three months old) of *Limulus:* by WILLIAM E. DAMON.

7. A curious, deformed, monstrous growth of a young Lobster claw, from Nova Scotia: by FREDERICK KATO.

8. Lens calipers, such as used by Frauenhofer: by FRANK D. SKEEL.

9. Lathe chuck for centring lenses, such as used in 1828: by FRANK D. SKEEL.

Mr. Walker remarked that while Mr. Helm, at the same locality whence these exhibits were taken, found *Cordylophora coronata* abundant in 1891, and in 1892 found only *C. lacustris*, he (Mr. Waiker) in the present year found *C. coronata* so abundant that it appeared to cover every immersed leaf and stem examined.

Mr. Damon explained some of the habits of *Limulus:* The female crawls up the beach, digs in the sand, lays about one pint of eggs, and returns to the water again during the same tide. The eggs hatch in three or four days, disclosing the young in this stage lacking the telson. The young crawl under the surface of the moist sand to the water, and shed the shell in one week, and then the telson first appears.

MEETING OF NOVEMBER 15TH, 1895.

The President, Dr. Edw. G. Love, in the chair.

Forty persons were present.

Messrs. George W. Kosmak and Horace W. Calef were appointed Committee on Annual Exhibition.

Dr. Alexis A. Julien read a paper, entitled "Sand; the Method of its Study." This paper was illustrated by numer-

ous pieces of apparatus and by numerous specimens, as noted below, and is published in abstract in this number of the JOURNAL.

OBJECTS EXHIBITED.

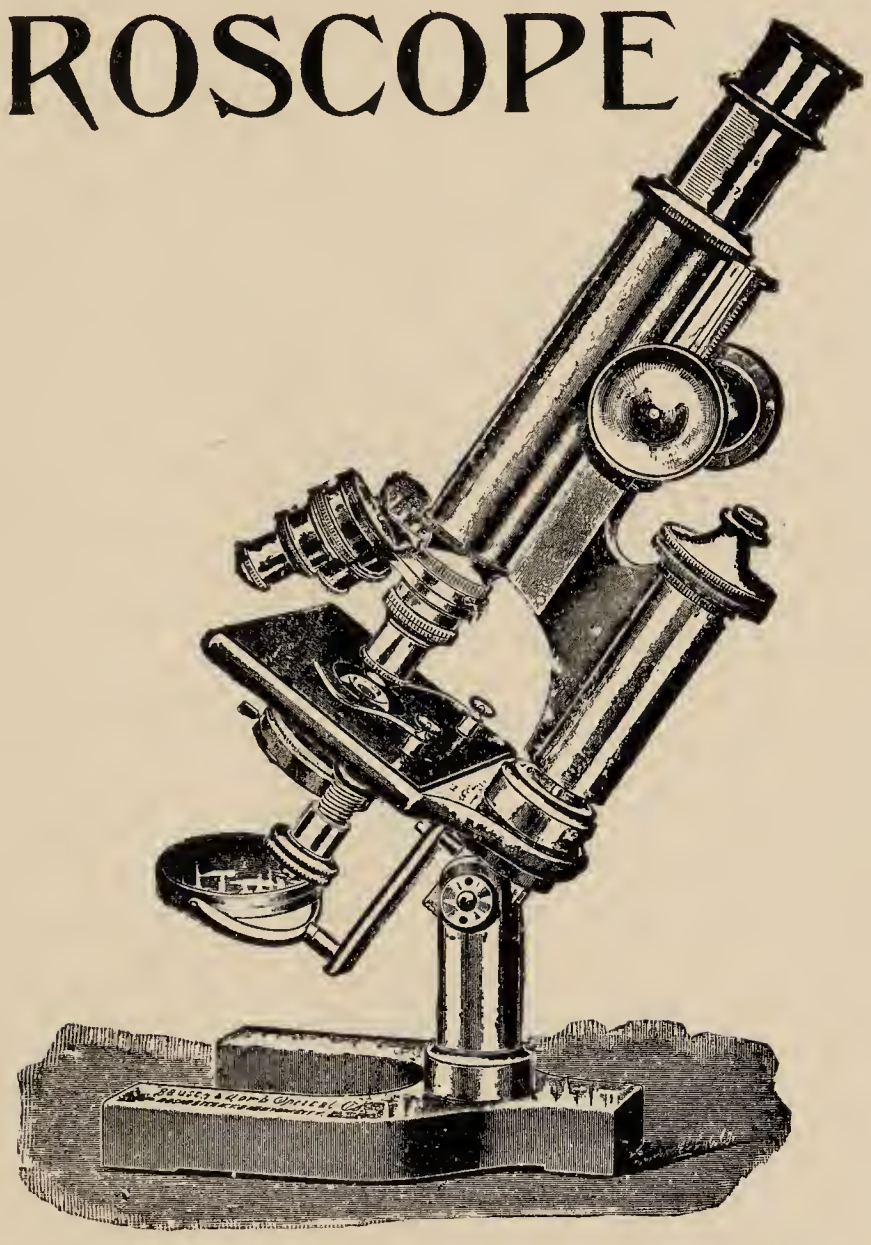
1. Tube and sand to illustrate sonority of sand.
2. The Jackson micrometer for determining sizes.
3. Set of nine sieves for sorting.
4. Set of bottles of sorted grains from 1 mm. to 0.1 mm.
5. Apparatus and chemical solutions used for mechanical separation.
6. Fusion mixture (chloride of lead and zinc) for the mechanical separation of the heavier grains.
7. Set of trial minerals for specific gravity test.
8. Apparatus, test liquids, and test grains for determination of refractive index. (Liquids of index, 1.46 to 1.60.)
9. Micro-spectroscope to determine constituents by means of the absorption spectra.
10. Szabó's flame reaction apparatus.
11. Feldspathic sand, with inclusions or black mica (biotite) in the feldspar and quartz grains, from Far Rockaway, N. Y.
12. A thin ground section of feldspathic sand, from Manchester, Mass.
13. Disintegral sand (just after separation from the matrix, and full of silt), from Cairo, Egypt.
14. Magnetite, particles concentrated from the silt of the river Danube.
15. Iridescent columbite found in sand at Nantucket, Mass.
16. Zircon, prisms, picked from sand from Coronado Beach, Cal.
17. Monozite, in monoclinic prisms (rich in lanthanum, thorium and cerium), from Burke Co., N. C.
18. Heavy and rare minerals (zircon, rutile, &c.) concentrated by sieving from sand from Far Rockaway, N. Y.

Exhibits Nos. 1–18: by ALEXIS A. JULIEN.

19. Chaldni figures, made best by angular sand, and transferred to paper: by ALFRED M. MAYER.

WELLCOME LIBRARY INSTITUTE

THE NEW BB CONTINENTAL MICROSCOPE



SEND FOR 1896 CATALOG

New Microscopes, New Microtomes,
New Bacteriological Apparatus,
New and Improved Accessories and
Laboratory Supplies.

NEW PRICES.

BAUSCH & LOMB OPTICAL CO.

130 Fulton Street,

ROCHESTER, N. Y. NEW YORK CITY.